CLAIMS

What is claimed is:

1. A method of lithographically patterning a metal deposited onto a HgI_2 crystal, comprising the steps of:

depositing a metal layer onto a HgI_2 crystal surface;

spinning adhesion promoter onto said metal layer;

spinning photoresist onto said adhesion promoter;

soft-baking said photoresist to remove moisture;

aligning a mask to said photoresist;

exposing a portion of said photoresist that is not concealed by said mask to produce exposed photoresist and unexposed photoresist;

removing said mask from said photoresist;

developing and removing said exposed photoresist;

soft-baking said photoresist a second time;

etching said metal layer;

flood exposing said unexposed photoresist to produce a second exposed photoresist; and

developing and removing said second exposed photoresist.

2. The method of claim 1, wherein said metal layer comprises metal selected from the group consisting of palladium, gold, carbon, indium-tin-oxide, chromium, tantalum and platinum.

3. The method of claim 1, wherein the step of spinning adhesion promoter is carried out with HMDS at about 3000 rpm for about 20 seconds.

4. The method of claim 1, wherein the step of spinning photoresist is carried out with OCG 825 at about 3000 rpm for about 20 seconds or until said photoresist is about 1.3 μm thick.

5. The method of claim 1, wherein the step of soft-baking said photoresist to remove moisture is carried out at about 90°C ambient temperature for about 2 minutes, wherein said photoresist temperature does not exceed 50°C.

6. The method of claim 1, wherein the step of exposing said photoresist is carried out at about 200 W with a Hg lamp at an exposure time of about 1.8 minutes.

7. The method of claim 1, wherein the step of developing said photoresist is carried out with a mixture of about 2:1 TMAH: H_2O for about 50 seconds followed by rinsing with H_2O and drying with N_2.

8. The method of claim 1, wherein said metal layer comprises palladium, wherein the step of etching said metal layer is carried out with a mixture of about 2:10:30 of Br:HNO_3:HCl for about 1 minute.

9. The method of claim 1, wherein the step of flood exposing said unexposed photoresist is carried out with about 200 W from a Hg lamp at an exposure time of about 2.5 minutes.

10. The method of claim 1, wherein the step of developing and removing said second exposed photoresist is carried out with a mixture of about 2:1 of TMAH: H_2O for about 2 minutes followed by rinsing with H_2O and drying with N_2.

11. The method of claim 1, wherein the step of developing and removing said second exposed photoresist will produce uncovered HgI_2, the method further comprising subliming said uncovered HgI_2 to produce trenches.

12. The method of claim 11, wherein said HgI_2 crystal is held at a vacuum pressure that is less than 11 mTorr, wherein sublimation is governed by temperature of the HgI_2 surface.

13. The method of claim 12, wherein said vacuum pressure is about 3 mTorr and said temperature is within a range of about 95-120°C.

14. The method of claim 11, further comprising depositing metal into said trenches.

15. The method of claim 1, further comprising smoothing said HgI_2 crystal surface prior to the step of depositing a metal layer.

16. The method of claim 15, wherein the step of smoothing said HgI_2 crystal surface further comprises:

placing said HgI_2 crystal into a solution of $KI:H_2O$; and

agitating said solution.

17. The method of claim 16, wherein said $KI:H_2O$ is at a mixture of about 1:10.

18. The method of claim 16, where the KI in said solution is about 5% to 15% of said solution.

19. The method of claim 16, further comprising agitating said solution at an agitation rate within a range from about 100 rpm to about 200 rpm.

20. The method of claim 16, wherein the step of agitating said solution comprises (i) agitating said solution in a mixture of about 1:10 of KI:H_2O at about 200 rpm with a magnetic stir bar for about 30 seconds at each orientation of 0°, 180°, 270° and 90°, (ii) rinsing said crystal with H_2O and (iii) drying said crystal with N_2.

21. The method of claim 1, wherein the step of depositing a metal layer comprises sputtering metal onto said HgI_2 crystal surface.

22. The method of claim 1, wherein the step of depositing metal is carried out with a metal deposition technique selected from the group consisting of metal sputtering and metal evaporation.

23. The method of claim 22, wherein said HgI_2 crystal is placed in a vacuum prior to metal deposition, wherein said vacuum comprises a low base pressure.

24. The method of claim 22, wherein said HgI_2 crystal is cooled to promote metal adhesion.

25. The method of claim 24, wherein said HgI_2 crystal is cooled to a temperature of about -15°C.

26. The method of claim 25, wherein said HgI_2 crystal is cooled with a two-stage Peltier cooler.

27. The method of claim 23, wherein said low base pressure is less than about 1 x 10^{-6} T.

28. The method of claim 21, wherein the step of sputtering metal onto said HgI_2 surface further comprises:

placing said HgI_2 crystal into a vacuum chamber having a base pressure of less than about 1×10^{-6} T;

cooling said HgI_2 crystal to about -15 °C;

filling said vacuum chamber with a working gas for sputtering; and

depositing metal onto said HgI_2 crystal surface.

29. The method of claim 28, wherein said working gas for sputtering comprises Ar at about 5 mTorr.

30. The method of claim 28, wherein said metal is deposited at a rate of about 700 Å/minute for about 2 minutes.

31. The method of claim 28, wherein the step of depositing metal comprises depositing palladium.

32. The method of claim 1, further comprising attaching wires to said metal layer, wherein said wires are for applying electrical voltages and providing electrical connection to signal conditioning electronics.

33. The method of claim 32, wherein said wires are attached to each set of said metal layers using material selected from the group consisting of carbon aquadag and colloidal suspension of graphite particles.

34. The method of claim 1, further comprising depositing insulating material onto said HgI_2 crystal surface and said metal layer.

35. The method of claim 34, wherein said insulating material is parylene C.